<u>REMARKS</u>

Initially, applicants would like to thank Examiner Shumate for granting an interview and for his time spent during the interview. Applicants would also like to thank Primary Examiner Greene for attending the interview and for his input during the interview.

The application has been amended to place it in condition for allowance at the time of the next Official Action.

Claims 18-27 and 29-37 were previously pending in the application. Claims 19, 31-33 and 37 have been canceled and new claim 38 is added. Therefore, claims 18, 20-27, 29, 30, 34-36 and 38 are presented for consideration.

Canceling claim 37 is believed to render moot the claim objection.

Claims 18-27 and 29-37 were rejected under 35 USC 103(a) as being unpatentable over OHNO et al. WO 01/23069 in view of KOTANI et al. US 5,629,067. That rejection is respectfully traversed.

Background Arguments

Before commenting the patentability of claim 18, the objects underlying the invention as it refers to an assembled filter body are reviewed below.

During regeneration, very high thermo-mechanical stresses appear in filter bodies. These stresses result from

temperature gradients, i.e. from differences of temperatures, generating differences of dilatations, and consequently, differences of volume increases.

A first way to limit thermo-mechanical stresses is to make the blocks with a material presenting high thermal conductance (so that heat quickly flows away from the blocks).

A second way is to have walls with a uniform thickness across a block (so that the "streets" for the flow of heat have the same width everywhere) to avoid the accumulation of heat at any point.

A third way is to insert seals. A seal between two blocks will receive heat from these blocks and should be able to "store" said heat. Therefore, it should be as heat insulating as possible and usually has a thermal conductance which is much lower than that of the blocks. For instance, as described in OHNO, the thermal conductance of the seals is typically ranging between 0.1 W/mK to 10 W/mK (see claim 7) and the thermal conductance of the material of the blocks is typically of about 20 to 80 W/mK (see column 6, lines 8 to 11).

Consequently, the temperature gradient within the seals is much higher than within the blocks. Typically, differences of several hundred degrees Celsius are possible between the seals and the blocks.

Therefore very high thermo-mechanical stresses appear at the interfaces between the blocks and the seals.

Finally, to allow an efficient heat transfer between the blocks and the seals, a close contact is also usually regarded as advantageous. To cope with the dilatation of the blocks, the seals should therefore be elastic (and, for instance, contain fibers) to absorb the change of size of the blocks during regeneration. For this reason in particular, the seals are usually not sintered, but simply dried. Also, their composition is usually quite different than the composition of the blocks.

From the above, it is clear that for an assembled body to be used in a filtering application, sintered, uniform and thermally conducting blocks are usually separated by dried (not sintered), elastic, and thermally insulating seals. Usually, an assembled body has therefore a very composite nature.

By contrast, in a monolithic filter body, there are no stress and heat absorbing seals. Consequently, a thermally insulating fibrous and elastic mat is usually disposed between the lateral outside surface and the metallic envelope ("can") in which the filter body is incorporated. In addition, a coating is usually applied on this outside surface so as to mechanically reinforce the body. Such a coating is not regarded as advantageous as far as temperature gradients are concerned, since it is contrary to the uniformity of the body. Rather, it should be regarded as a drawback which is to be accepted for the sake of mechanical resistance.

Arguments Regarding claim 18

With the above in mind, Claim 18 recites: blocks and seals assembled with the blocks, the nature of a material of said seals being different than the nature of a material of said blocks.

The claimed filter body is therefore a composite filter body and, as is explained above, very high thermal mechanical stresses appear at the interfaces between the heat insulating seals and the heat conductive blocks.

The problem of stresses at said interfaces is specific to assembled filter bodies and one of ordinary skill in the art would have not searched a solution to this problem using documents dealing with monolithic bodies (in which this problem does not occur).

Thus, as pointed out at the interview, contrary to the position set forth in the Office Action, one would not have tried improving the strength of the blocks of OHNO by applying a coating as taught by KOTANI.

Such a conclusion is based on an *ex post facto* analysis. Although applying a coating on the lateral outside surface of monolithic bodies had been known for a long time (see for instance, wherein KOTANI cites JP-U-50-48 858 (column 2, line 56) which was published in December 1974), which is about twenty years before the present invention, nevertheless, there is no

suggestion in KOTANI or any other reference of increasing the mechanical strength <u>of an assembled body</u> by increasing the thickness of walls of constituting blocks. Rather, such solution is only based on the disclosure of the present invention.

As pointed out at the interview, the reason why no such suggestion was previously presented is because the same is contrary to the accepted wisdom in the art.

Indeed, for a given volume of an assembled body, a man of ordinary skill in the art would have thought that an increase in a wall thickness would have been either <u>detrimental to the volume of the related channels</u>, which would have negatively impacted on the efficiency of the filter body, reduced its storage capacity, and increased the pressure drop, or <u>detrimental to the thickness of the seal</u>. Since, as set forth above, the properties and functions of the material of the seals are very different than that of the blocks, he would have thought that this thickness decrease would have changed the way the assembled filter body behaves during regeneration and that additional changes in the filter body would have been required.

In addition, as set forth above, he would have thought that this modification would have <u>changed the temperature distribution</u> inside the filter body, in particular due to a non-uniformity of the wall thickness, and created <u>additional thermo-mechanical stresses</u>. In fact, he might even have thought that an

increase of the wall thickness <u>inside the filter body</u> could be <u>detrimental</u> to the strength of the assembled filter body.

Contrary to the accepted wisdom in the art, the present inventors have discovered that a <u>limited</u> additional thickness with a ratio R of 3 or less, or even better, of 2.1 or less (see claim 27) does not substantially change the performance of the filter body. Rather, it efficiently limits the cracks, especially at the interfaces with the seals. Applying a limited additional thickness goes against the prejudices here above described, and therefore was not obvious.

Moreover, KOTANI discloses that the thickness of the outer coating is the range 0.1-1 mm (column 10, lines 8 and 9). From figure 4, it appears that this means that the outer coating has a thickness which varies when turning around the filter body. The coating thickness will vary from 0. 1 mm (for instance on the left side of figure 4) to 1 mm (in the middle of figure 4).

This interpretation of KOTANI is also confirmed by the fact that, in the case of figure 4, a single coating thickness cannot be easily determined for the coating of the filter body.

In the <u>same</u> filter body, the ratio R would therefore vary from 7.7 to 1.7. This cannot suggest any advantage associated with ratios R of 3 or less.

In addition, a ratio R higher than 3 would significantly increase the thermal inertia, which would lead to very high temperature gradients at the periphery of the blocks

and, consequently; as explained previously, could lead to cracks in the blocks or at least to a lower combustion of the soot in the center of the blocks.

Nevertheless, claim 18 recites that the ratio R is "always" 3 or less.

On the contrary, as explained here above, it appears that in a single filter body of KOTANI, R always reaches values much higher than 3. This does not suggest that ratio R should always be less than 3, and, even less, that it should preferably be less than 2.1.

Claim 18 further recites: "comprising an assembly of one-piece blocks".

The passage on page 4, lines 21 and 22 of the description explains that this means that "the reinforcement is not added onto the filter block, but is one piece with it ". In other words, the reinforcement is made simultaneously or "integrally", with the filter block. As explained at page 4, lines 23 to 26, "The stiffness of the filter block and its resistance to cracking are thereby advantageously improved. Furthermore, any risk of delamination of material forming the reinforcement is thereby advantageously eliminated. Finally, the fabrication of the filter block is thereby simplified. "

KOTANI refers to honeycomb structures which, at the exit of the extrusion die, tend to be distorted or deformed

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(especially the peripheral cells) by collapsing due to their own weight (column 2, lines 13 and 22; column 2, lines 43 to 49).

A reinforcement would increase said collapsing.

As pointed out at the interview, KOTANI therefore teaches away from extruding a block which presents a reinforcement as it is extruded.

In fact, it is an essential characteristic of KOTANI that the outer wall of a ceramic honeycomb body is not integrally formed: "In view of the above, the ceramic honeycomb body of the ceramic honeycomb structure according to the present invention does not have an integrally formed outer wall" (column 5, lines 60 to 62).

Further, as disclosed in column 8, lines 12 to 14 of KOTANI, "a coating material is favourably used which contains the above indicated cordierite particules and/or ceramic fibers and colloidal oxides as major components ". Indeed, "the use of such ceramic fibers is advantageous in avoiding cracks" (column 7, lines 47 and 48) and colloidal oxides enhanced heat resistance of the outer coating (column 7, lines 51 to 65). In addition, the material of the coating of all the examples always contains cordierite and between 10 and 35 % of an inorganic binder (see table 2). This material is always different than the material of the monolithic structural body, which only contains cordierite.

KOTANI therefore suggests to one of ordinary skill in the art using a coating material which has a composition

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different than the material of the structural body. KOTANI therefore teaches away from one-piece blocks where the reinforcement has the same material nature as the blocks, as required by claim 18.

Yet further, claim 18 recites: "wherein the thickness of said reinforcing partition is substantially constant".

Such a constant thickness is not possible with a filter body according to KOTANI since this filter body comprises only peripheral square cells "which are open to the outside in the radial directions" (column 6, lines 4-5) and, after the application of the coating, should have "a suitably controlled outer diameter and cylindricity" (column 6, lines 44 to 45).

Therefore, KOTANI cannot suggest a constant thickness.

Moreover, KOTANI explains that "it is difficult to form by molding an outer wall having a uniform thickness as an integral part of the structure" (column 2, lines 41-42). KOTANI therefore teaches away from the combination of one-piece blocks and constant thickness.

In view of the above, it is believed to be apparent that it would not have been obvious to modify OHNO in view of KOTANI to meet claim 18. The dependent claims are believed to be patentable at least for depending from an allowable independent claim.

In addition, as to claim 35, KOTANI teaches that a reinforcing member should be provided on the outer wall of the

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structure so that the structure may resist to canning (column 2, tine 36). The canning is the operation during which the filter body is inserted into an envelope, generally a metallic envelope, of the exhaust gas line. This insertion therefore specifically concerns the peripheral cells of the filter body. According to this teaching, one of ordinary skill in the art would have had no reason for reinforcing the rectangular parallelepiped blocks <u>inside</u> the filter body of OHNO.

Accordingly, claim 35 is believed to be patentable independently of the patentability of claim 18.

Discussion of Reference Cited in Co-Pending Application

As pointed out during the interview, during prosecution of co-pending application 10/583,941, a document MATSUBARA (EP 0 867 222) was cited. MATSAUBARA is listed on an IDS submitted herewith.

However, for the reasons set forth below, MATSUBARA either alone or in combination with OHNO does not render obvious the present claims.

MATSUBARA deals with monolithic bodies. The arguments above for KOTANI (except about the one-piece blocks and the constant thickness) apply to MATSUBARA.

In addition, claim 18 recites a ''filter body".

MATSUBARA discloses a monolithic ceramic structural body intended <u>to support a catalyst</u> so as to decrease harmful

components in the exhaust gas (page 3, lines 32 to 35). Such body is not a filter body and MATSUBARA does not mention, nor suggest filtration.

In the application described in MATSUBARA, it is desirable that the surface of catalyst exposed to the gas remains as large as possible. The surface of the channels should therefore not be soiled with soot. This is the reason why both ends of the channels are opened (otherwise the flow of gas would be forced through the channel walls, and there would be an undesirable accumulation of soot).

Closing every other end of the channels of the structural body of MATSUBARA so as to create inlet and outlet channels would have therefore completely modify its function, and even would have been detrimental to this function and thus, would not have been obvious.

In addition, it is not apparent that such a modification of the structural body of MATSUBARA would have been enough to transform it into a filtering body. Indeed, the catalyst on the surface of the channel walls might prevent any flow of gas through the structural body.

Further, MATSUBARA deals with a structural body with very low wall thickness (less than 0.15 mm, see claim 4). In filtration of exhaust gases, wall thickness is usually about 0.3 mm, i.e. twice the thickness of the walls described in MATSUBARA.

Indeed, under 0.3 mm some particles may go through the wall without being filtered, which decreases the efficiency.

In addition, the walls serve as a reservoir for the soot and a minimum thickness is required.

Finally, decreasing the width of the walls of a filter body would decrease its mechanical resistance. With a thickness of 0.15 mm, this resistance would have been too low to resist a severe regeneration.

Indeed, the thermo-mechanical stresses that the structural body described in MATSUBARA would support are not of the same order as that of a filter block according to claim 18.

In a filtering application, the highest thermo-mechanical stresses appear during the regeneration phases when the soot is burnt. As explained in detail at page 2, lines 19 to 31, the combustion zones are not uniformly distributed in the filter block, which results in a non-uniformity of the temperatures and generates high amplitude local stresses. Since there is no regeneration phase in the application described in MATSUBARA, no such stresses appear.

Generally, one of ordinary skill in the art would not consider combining a document exclusively dealing with the catalyst of gas, such as MATSUBARA, where the catalyst should remain exposed to gas, with a document dealing with the filtration of gas, such as OHNO, where the filter block should be

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configured so as to force the flow of gas across the channel walls to retain the soot.

Besides, like KOTANI, MATSUBARA deals with the deformation of the peripheral channels during the extrusion of a monolithic structural body. Indeed, as explained at page 4, lines 28 to 35 and represented in figure 3, with low wall thicknesses, the extrusion of a monolithic structural body tends to deform the internal walls of peripheral irregular channels.

(In KOTANI, the example of structural body also has a wall thickness of 0.15 mm and the present inventors consider that this body was intended for an application as a catalyst support).

In KOTANI, a peripheral coating is applied onto the peripheral outside surface of the body. But, at this stage, the wall delimiting the cells are rigid (the body has been sintered) and cannot be deformed anymore.

MATSUBARA suggests another solution, i.e. providing a thicker outer peripheral wall through extrusion and, to avoid collapsing of the peripheral channels, increasing the internal wall portions of some peripheral channels.

As explained about KOTANI, for a filtering body, this is <u>detrimental</u> to the uniformity of the body and for the generation of <u>thermo-mechanical</u> stresses during the regeneration.

Finally, the problems which are dealt with by MATSUBARA are specific to structural bodies "having a circular or ellipsoidal shape at lateral section and including square open-

ended cells defined by cell walls having a uniform thickness"
(page 4, lines 3 and 4). For these structural bodies, MATSUBARA
has discovered that the above mentioned problems were due to the
cell wall of the peripheral cells which are not perpendicular to
the outer peripheral wall.

When a filter block includes square cells, the edges of
the peripheral cells are usually substantially perpendicular with
the outer cell wall at the point of junction. See for instance
figures 3, 5 to 33 in OHNO.

In conclusion, it appears that the problems which are
solved by MATSUBARA would not be encountered with filter blocks,
and in particular with the filter blocks described in OHNO.

Therefore, there would be no motivation for one of
ordinary skill in the art to trying combining MATSUBARA with
OHNO.

On the contrary, as explained for KOTANI, increasing
the thickness of walls of some channels as taught by MATSUBARA
would reduce the section of these channels, and therefore would
have lead to an increased pressure drop. Also, it would have
reduced the soot storage capacity of the filter block. At first
sight, the man skilled in the art would therefore understand this
to be a teaching away from such a combination.

Therefore, one of ordinary skill in the art would
understand that he could not apply the teaching of KOTANI or
MATSUBARA for assembled blocks.

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Arguments Regarding OHNO

During the interview, the Examiners pointed out that based on the values for the radius of curvature disclosed on column 12, lines 1 to 9 of OHNO, the outer walls of the filter block of OHNO appear thicker than the internal walls 13 and that OHNO appears more relevant than initially thought.

However, the radius of curvature is a variable which is independent of the thickness of the outer walls, i.e. a radius of curvature used to define surfaces at the angles of a filter block is not necessarily linked to the thickness of the outer walls.

Indeed, it would only be so if:

1) the round surface connects tangentially to the plane surfaces, whatever the radius of curvature is, and

2) the centre of curvature is fixed, whatever the radius of curvature is.

Such requirements are not disclosed in OHNO.

On the contrary, it is disclosed at column 12, lines 14 to 16 that "if the radius of curvature R exceeds 2.5 mm, the cross-sectional area of the honeycomb filter FI decreases. This reduces the effective number of cells and decreases the filtering capability of the assembly 29."

In other words, if the radius of curvature is less than 2.5 mm, the cross sectional area of the filter block FI does not

decrease so that the effective number of cells would be reduced and the filtering capability of the assembly 29 would decrease.

From this passage it is therefore clear that OHNO has only contemplated increasing the radius of curvature, without increasing the thickness of the outer wall portions, while <u>moving the centre of curvature</u> towards the inside of the filter block.

Indeed, as seen by way of example in the explanatory drawings, reproduced below, with such an increase of the radius of curvature, the centre of curvature moves from C_1 to C_3 while the round surface changes from ζ_1 to ζ_3. Doing so, the round surface 18 approaches the corner cell and may reach the corner cell when this radius exceeds 2.5 mm (see ζ_3). This corner cell would therefore not be effective anymore and this would decrease the filtering capability of the assembly 29. Till ζ_3, the effective number of cells and the filtering capability of the assembly 29 are maintained.
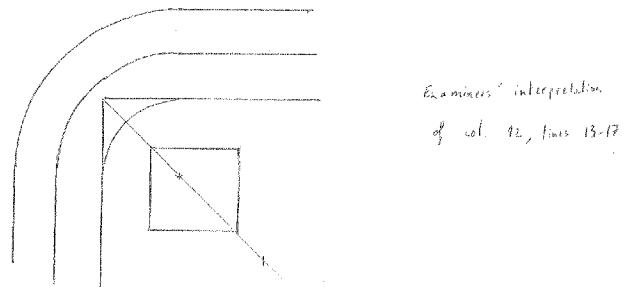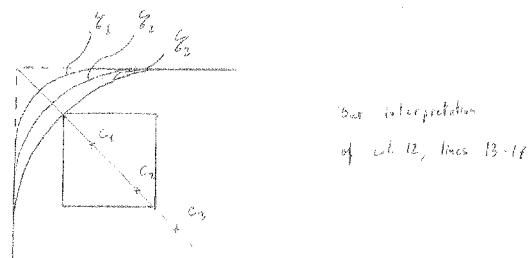
On the contrary, the interpretation of OHNO by the Examiners is not compatible with the above-noted passage of OHNO.

Indeed, increasing the thickness of the outer wall simultaneously with the radius of curvature would <u>immediately</u> lead to a decrease of the filtering capability <u>of the assembly 29</u> since the blocks would become bigger. In addition, there would be <u>no step</u> at a radius of 2.5 mm.

Finally, one of ordinary skill in the art would have been lead away (<u>teaching away</u>) from increasing the thickness of the outer wall with the radius of curvature since it was clear that this would decrease the filtering capability and that it was precisely to <u>avoid this problem</u> (column 12, lines 16-17) that the radius of curvature is explicitly limited to 2.5 mm in OHNO.

As to the Figures of OHNO, if one were to consider that measurements on the figures appear to reveal a thickness ratio about 1.5, such a conclusion is inconsistent with the disclosure of OHNO. Indeed, the drawings are clearly schematic figures and do not represent the invention of OHNO.

For instance, if one were to consider that the thickness of the cell wall 13 is about 0.3 mm, as disclosed on column 5, line 58, the figures would mean that <u>the width of the filter blocks would be about 5 mm</u>, which has nothing to do with reality. This would be also in contradiction with the passage column 18, lines 46, which states that the cross-sectional area S

should preferably be between 400 and 2,500 mm^2, i.e. the filter width should preferably be between 20 mm and 50 mm.

In particular, one may observe that the dimensions of a filter block, as represented in figures 17 of OHNO are typically about 33 mm (see for instance column 18, line 58) or 50 mm (see column 19, lines 17 and 18) or 70 mm (column 20, line 1).

In addition, one may observe that for the same blocks FI, Fig. 5 and Fig. 13 (or 15) do not represent the same thickness ratio! In Fig. 15 the outer wall is represented with about the same thickness as the internal walls.

In view of this, it is apparent that the drawings are highly schematic and should not be used to take any measure or, even less, to compare any dimensions.

It is believed that the drawings of OHNO are only intended to improve the understanding of the invention of OHNO.

Since there is no indication in the description, as explained previously, about an increase of the width of the outer wall, and even less, any hint about any technical advantage associated with such an increase, we consider that the drawings should not be used, *a posteriori* to demonstrate that the figures are conforming to present claim 18.

In view of this, OHNO does not meet claim 18 or the claims that depend there from.

In addition, OHNO does not disclose any of the additional features of claims 27, 38 or 40. Accordingly, these

claims are believed to be patentable independent of the patentability of claim 18.

In view of the above, not only do the references either alone or in combination fail to disclose each of the recited features, but also the references could not combined with each other or another reference to meet the present claims.

New claim 38 is added. Support for this claim can be found in the Figures and on page 6, lines 31-34.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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